

Evaluation of the Effects of Elk Creek Dam on Migratory Salmonids

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SUMMARY

Rogue FishBio Services, Inc. (RFBS) resumed responsibility for operation and maintenance of the Elk Creek fish collection facility for the fourth season, effective 1 October 2006, under contract with the U.S. Army Corps of Engineers (USACE). The primary purpose of the program is to provide fish passage past Elk Creek Dam by trapping and transporting adult and juvenile salmonids and other fish species past the Elk Creek Project. RFBS operated the facility through 12 May 2007, when seasonal field activities were completed.

Trap catches of adult salmonids at the collection facility in the 2006-2007 return year totaled 795 unmarked and 244 marked coho salmon (*Oncorhynchus kisutch*), 1,170 wild and 12 hatchery steelhead (*O. mykiss*), 9 unmarked and 1 marked chinook salmon (*O. tshawytscha*), and 149 wild cutthroat trout (*O. clarki*). All fish, except for all marked coho salmon of hatchery origin, were successfully transported and released upstream of the dam.

The estimated number of 755 wild adult coho salmon returning to Elk Creek this season was the sixth highest count in the project history. Adult returns of hatchery fish to Gold Ray Dam suggest that ocean environmental conditions were more favorable to survival of adult steelhead returning this season than to survival of adult coho salmon. No evidence was found to indicate that freshwater factors had an unusually favorable or unfavorable impact on adult escapement of coho salmon or steelhead. Wild adult coho salmon and wild steelhead that returned to the collection facility on Elk Creek accounted for 15.5% and 7.5%, respectively, of the number of each species that passed the fish counting station at Gold Ray Dam in 2006-07.

Season totals of 15 adult coho salmon, 65 adult steelhead and 5 adult cutthroat trout carcasses were found on the upstream side of the weir. Samplers judged that 100% (5 of 5) of female coho salmon, 89.3% (25 of 28) of female steelhead and 50% (1 of 2) of female cutthroat trout recovered as carcasses on the weir had completed spawning.

INTRODUCTION

The following background information was previously reported by the Oregon Department of Fish and Wildlife (Satterthwaite 2003).

Elk Creek enters the Rogue River at River Kilometer (RK) 244. Elk Creek Dam is located 2.6 km upstream from the creek mouth. The basin covers about 351 sq km, of which 343 sq km are upstream of Elk Creek Dam. Mean monthly flow is less than 10 cubic feet per second (cfs) in late summer and is 400-600 cfs in winter. Mean monthly flow in winter peaks between 1,000 and 1,800 cfs.

Coho salmon, steelhead, chinook salmon, and cutthroat trout spawn in the Elk Creek Basin. Coho salmon in the Southern Oregon and Northern California ESU are presently listed as threatened by the National Marine Fisheries Service (NMFS) under the Endangered Species Act (Federal Registry 1997). Small numbers of spring chinook salmon and fall chinook salmon spawn in Elk Creek when flow increases enough in autumn to permit upstream migration. Adult cutthroat trout also migrate into Elk Creek, although these fish do not appear to be anadromous.

Elk Creek Dam is one of three dams authorized by the United States Congress and constructed by the United States Army Corps of Engineers (USACE) in the Rogue River Basin. The other dams, Lost Creek and Applegate, are fully

operational. A court order halted construction of Elk Creek Dam in 1987 after dam height had reached 83 feet.

Blockage of spawning areas used by anadromous fish in the Elk Creek Basin was to be mitigated by the production of coho salmon and steelhead at Cole M. Rivers Hatchery. This mitigation would start when Elk Creek Dam was fully constructed. A temporary fish collection facility was constructed downstream of Elk Creek Dam to capture salmon and steelhead broodstock for the hatchery program. The facility was expected to be operated for approximately four years following initiation of dam and reservoir operations. In an attempt to provide upstream passage for anadromous salmonids, after dam construction was halted, the diversion tunnel was altered by the installation of baffles.

Spawning surveys and trap catches of juveniles suggested that few adult coho salmon or steelhead passed the dam during the 1991-92 run year even though Oregon Department of Fish and Wildlife (ODFW) staff observed hundreds of adult salmonids immediately downstream of the dam. These observations increased concern that adult salmonids were unable to pass through the baffled diversion tunnel.

In response to that concern, under a cooperative agreement, USACE funded ODFW to operate the temporary fish collection facility and transport fish above the dam, beginning in autumn of 1992. Adult salmonids were trapped below the dam and were trucked and released upstream of the dam during the 1992-93 and 1993-94 run years. Trap catches totaled 38 coho salmon and 119 steelhead in 1992-93 and 86 coho salmon and 120 steelhead in 1993-94. Returns in both run years were very low compared with ODFW estimates of historic returns that averaged 1,560 coho salmon, 1,000 summer steelhead, and 2,000 winter steelhead (USACE 1980).

In 1995, USACE funded ODFW to evaluate the fisheries in Elk Creek. The project goal was to develop strategies to restore the natural production of self-sustaining migratory salmonids to a level appropriate for the habitat available in the Elk Creek Basin. Findings from the first nine years of work were reported by Satterthwaite et al. (1996a), Satterthwaite et al. (1996b), Satterthwaite and Leffler (1997), Satterthwaite (1998), Satterthwaite (1999), Satterthwaite (2000), and Satterthwaite (2001), Satterthwaite (2002), Satterthwaite (2003).

ODFW continued to manage the Elk Creek trap facility through 30 November 2003 when operation and maintenance responsibilities for the project were transferred to RFBS, effective 1 December 2003 under contract with USACE. Findings from the first three years of work under the contract with RFBS were reported earlier (Evenson 2004; Evenson et al. 2005; Evenson et al. 2006).

Principle contract objectives are to: (1) operate and maintain the Elk Creek trapping facility, (2) remove accumulated debris from three culverts located on tributaries within the Elk Creek Project area, (3) transport migratory salmonids and other migratory fish around Elk Creek Dam, and (4) determine the proportion of wild adult anadromous salmonids that return to Elk Creek Dam.

Fish collection and transport activities conducted by RFBS during the 2006-07 season are described in this report. Operation and maintenance issues regarding the Elk Creek trap and associated activities are described and discussed in Appendix C.

METHODS

Collection and Transport of Salmonids

Dry weather conditions and low stream flow persisted through October 2006 until a storm event increased stream flow substantially in early November. The trap water supply pump was started for sustained operation on 3 November when streamflow at the site was approximately 20 cfs. The collection facility was operated continuously and checked a minimum of once daily through 12 May 2006 when fish collection activities were discontinued for the season.

RFBS technicians or biologists recorded the species, fin marks, and classified the fish based on visual estimates of fork length. Samplers classified chinook salmon less than 60 cm as jacks, coho salmon less than 50 cm as jacks, and steelhead less than 41 cm as half-pounders. Project personnel transported and released all fish, except coho salmon of hatchery origin, in Elk Creek about one km upstream from the dam. Coho salmon were classified as hatchery fish if a fin clip and/or a maxillary clip was evident. All marked coho salmon were transferred by RFBS to Cole Rivers Hatchery alive in conformance to applicable NOAA Fisheries and ODFW handling permits.

RFBS inspected the weir daily for carcasses, as conditions allowed. Safety concerns caused by high stream flows prevented weir carcass inspection activities on 68 days during the 2006-07 season. Samplers examined all carcasses found on the weir and recorded species, sex and estimates (using professional judgment) to the nearest 25% of the proportion of unspawned eggs in the body cavities of females. Females judged to have retained less than 10% of their eggs were recorded as 100% spawned (Satterthwaite 1997, 1998).

Proportion of Fish that Returned to Elk Creek

RFBS estimated the Elk Creek contribution to runs of wild adult coho salmon and steelhead in the upper portion of the Rogue River Basin by dividing the number of fish trapped in Elk Creek by the number of counterparts that passed the fish counting station at Gold Ray Dam on the Rogue River at RK 204. We assumed that catches in the trap below Elk Creek Dam reflected the number of fish that attempted to return and spawn in the Elk Creek Basin.

We also assumed that all steelhead of hatchery origin were marked with fin clips because cohorts were all marked before release from Cole M. Rivers Hatchery. Different procedures were used to estimate the number of wild and hatchery coho salmon that returned to Elk Creek because some hatchery fish were not marked with fin clips. Collection data obtained from the hatchery was used to estimate the proportion of hatchery fish that could not be visually identified by clipped fins. In addition, a substantial number of coho salmon marked with a clipped maxillary bone, and likely originating from fish of hatchery origin released in the Klamath River Basin, have been captured at both the hatchery and the Elk Creek trap since the 2000-2001 return year. All coho salmon with clipped maxillary bones were considered hatchery fish but were not included in the fin mark data used to estimate the proportion of unmarked hatchery fish.

We obtained estimates of the number of wild adult coho salmon and wild steelhead that passed Gold Ray Dam from ODFW (T. Satterthwaite and R. Pellissier personal, communication 2007). We also obtained counts of fin-marked and non fin-marked coho salmon of hatchery origin that returned to Cole

M. Rivers Hatchery from ODFW (D. Pease, personal communication 2007). Collection records from the hatchery indicated that fin-clipped fish accounted for 85.8% of the jacks, and 88.3% of the adults, for coho salmon of hatchery origin that returned to Cole M. Rivers Hatchery in 2006-07. We used these estimates, and the number of coho salmon with clipped adipose fins captured at the Elk Creek trap, to estimate the number of non fin-clipped coho salmon of hatchery origin trapped at the Elk Creek collection facility.

RESULTS AND DISCUSSION

Collection and Transport of Salmonids

Trap catches of adult salmonids at the collection facility in the 2006-2007 return year totaled 795 unmarked and 244 marked coho salmon, 1,170 wild and 12 hatchery steelhead, 9 unmarked and 1 marked Chinook salmon, and 149 wild cutthroat trout. Weekly trap catches for these species are presented in Tables 1 and 2. Other fish collected at the facility included 59 juvenile steelhead/rainbow trout, 4 juvenile cutthroat trout and 8 Klamath smallscale suckers (*Catostomous rimiculus*).

The totals also included one wild steelhead that was marked with an adipose fin-mark and a left opercle punch, indicating that it had originally been captured at Cole Rivers Hatchery and later released back into the Rogue River to enhance angling opportunities.

Previous studies (Satterthwaite 1997) and observations by RFBS personnel during high flow periods indicated that we did not trap all of the adult salmonids that returned to Elk Creek. Various numbers of adult salmonids were observed throughout the season in the stilling pool downstream of Elk Creek Dam and upstream of the weir. Adult salmonids likely entered the stilling pool by either (1) swimming past the weir site before pickets were installed in early October, (2) jumping over the weir during high water periods, (3) dropping back downstream before spawning after being transported and released, or (4) dropping back downstream after spawning.

Two adult Chinook salmon, that may have migrated above the weir prior to the installation of pickets, were observed spawning a short distance upstream of the weir in mid-October. No other fish were observed upstream of the weir to indicate that additional adult salmonids passed above the weir site before installation of the pickets was completed on 3 October. In mid-April RFBS personnel estimated a peak count of 90-100 adult steelhead in the stilling pool area downstream of Elk Creek Dam and upstream of the weir, higher than peak counts for the 2004-05 and 2005-06 seasons (18-25 adult steelhead), but lower than the peak count for the 2003-04 season (200-220 adult steelhead). About 75% of these fish showed some visible sign of fungus. Project personnel also made several counts from December through March of fish attempting to jump over the weir during high-water events (Appendix B). Several fish were observed successfully passing the weir at flows as low as 815 cfs. From November through early April, mean daily streamflow measured at the USGS gage (Elk Creek at Trail) exceeded 800 cfs on 22 days.

Previous reports documented that many of the carcasses of adult salmonids that were recovered on the weir had been transported, and that some previously transported fish dropped downstream below the weir and re-entered the trap (Satterthwaite and Leffler 1997; Satterthwaite 1998, 1999). Marking of transported adult salmonids was discontinued following the 1998-1999 season. Thus, transported fish that were recovered as carcasses, or that passed over the weir and re-entered the trap, could not be identified or enumerated.

Table 1. Number of adult coho salmon, steelhead, and cutthroat trout trapped at the fish collection facility on Elk Creek, 2006-2007 return year. Coho salmon jacks were less than 50 cm long and steelhead half-pounders were less than 41 cm long. All cutthroat trout were longer than 30 cm and none exhibited hatchery marks. All fish were released upstream of Elk Creek Dam except that coho salmon known to be of hatchery origin were transferred to Cole M. Rivers Hatchery. Data may include fish transported multiple times.

Week of Cutthroat capture	Coho salmon				Steelhead				trout
	Jacks		Adults		Half-pounders		Adults		
	Unmarked	Marked	Unmarked	Marked	Wild	Hatchery	Wild	Hatchery	
10/15-10/21	0	0	0	0	0	0	0	0	0
10/22-10/28	0	0	0	0	0	0	0	0	0
10/29-11/04	0	0	19	5	0	0	0	0	0
11/05-11/11	0	0	105	28	0	0	8	0	2
11/12-11/18	0	1	322	74	1	0	138	0	23
11/19-11/25	4	1	189	70	1	0	116	0	15
11/26-12/02	0	0	24	17	0	0	3	0	1
12/03-12/09	0	0	18	16	0	0	0	0	0
12/10-12/16	1	0	82	23	10	2	231	0	42
12/17-12/23	2	0	8	6	0	0	6	0	0
12/24-12/31	0	0	10	2	1	0	68	0	16
01/01-01/07	1	0	8	1	2	0	26	0	7
01/08-01/14	0	0	2	0	0	0	10	0	1
01/15-01/21	0	0	0	0	0	0	0	0	0
01/22-01/28	0	0	0	0	0	0	1	0	0
01/29-02/04	0	0	0	0	0	0	1	0	0
02/05-02/11	0	0	0	0	1	0	34	0	1
02/12-02/18	0	0	0	0	3	0	129	0	17
02/19-02/25	0	0	0	0	0	0	32	0	1
02/26-03/04	0	0	0	0	2	0	32	0	11
03/05-03/11	0	0	0	0	0	0	67	0	10
03/12-03/18	0	0	0	0	1	0	83	0	1
03/19-03/25	0	0	0	0	1	0	52	2	0
03/26-04/01	0	0	0	0	0	0	42	1	0
04/02-04/08	0	0	0	0	0	0	28	0	1
04/09-04/15	0	0	0	0	0	0	12	0	0
04/16-04/22	0	0	0	0	0	0	17	4	0
04/23-04/29	0	0	0	0	1	0	8	3	0
04/30-05/06	0	0	0	0	0	0	2	0	0
05/07-05/13	0	0	0	0	0	0	0	0	0
Annual total	8	2	787	242	24	2	1,146	10	149

Fish Mortalities Caused by Trap and Transport Operations

No mortalities of either adult or juvenile salmonids that died as a direct result of trap and transport operations were observed by RFBS personnel during the 2006-07 season. However, trap and transport may have caused delayed mortality among adult salmonids. During the trap and transport season, samplers found a total of 15 adult coho salmon, 65 adult and 1 juvenile steelhead, 5 adult and 1 juvenile cutthroat trout, 1 adult sucker and 1 bullhead on the upstream side of the weir. Samplers judged that 100% (5 of 5) of female coho salmon, 89.3% (25 of 28) of female steelhead and 50% (1 of 2) of female cutthroat trout recovered as carcasses on the weir had completed spawning. Observations of adults in the stilling basin immediately downstream of Elk Creek Dam suggested that steelhead kelts may be adversely affected by delays in their downstream migration, and that some may die because they are delayed or unable to migrate downstream due to the weir. Counts conducted in April of adults (likely comprised mainly of steelhead kelts) noted that about 75% showed indications of fungus infections. Had the weir not been present, some steelhead kelts may have survived to make another spawning migration during the succeeding year.

Table 2. Number of adult Chinook salmon trapped at the fish collection facility on Elk Creek, 2006-2007 return year. Jacks were less than 60 cm long. Data may include fish transported multiple times.

Week of capture	Jacks		Adults	
	Unmarked	Marked	Unmarked	Marked
10/15-11/21	0	0	0	0
10/22-10/28	0	0	0	0
10/29-11/04	0	0	0	0
11/05-11/11	0	0	0	0
11/12-11/18	1	0	5	0
11/19-11/25	3	1	0	0
11/26-12/02	0	0	0	0
12/03-12/09	0	0	0	0
12/10-12/16	0	0	0	0
12/17-12/23	0	0	0	0
Annual total	4	1	5	0

Proportion of Fish that Returned to Elk Creek

Returns of hatchery coho salmon (estimated to include unmarked hatchery fish) and hatchery steelhead that were trapped in Elk Creek during 2006-07 accounted for 3.8% and 0.1%, respectively, of the number of hatchery fish for each species that passed the fish counting station at Gold Ray Dam. Returns of wild adult coho salmon and wild steelhead to the collection facility on Elk Creek accounted for 15.5% and 7.5%, respectively, of the number of wild fish of each species that passed Gold Ray Dam in 2006-07 (Table 3).

The area upstream of Elk Creek Dam accounts for approximately 9.5% of the area considered accessible by ODFW to one or more species of anadromous salmonids that pass Gold Ray Dam (Satterthwaite 2002). Previous reports reasoned that the Elk Creek basin should produce at least a comparable percentage of coho salmon and steelhead because both species spawn in

tributaries rather than in the Rogue River (Rivers 1964; Satterthwaite 2000). For most years since the trap and transport program began in 1992, the returns of wild adult coho salmon to Elk Creek have exceeded the provisional goal of 9.5% of the estimated number of wild fish passing the fish counting station at Gold Ray Dam. The proportion (15.5%) of wild adult coho salmon returning to Elk Creek in 2006-07 was the sixth highest percentage estimated since the trap and transport project began, while the total of 755 wild adult coho salmon returning to Elk Creek also ranks as the sixth highest count recorded in the project history.

Important physical and biological factors in the freshwater and marine environments that may influence the abundance of returning wild coho salmon to Elk Creek were previously discussed (Satterthwaite 2001; Evenson 2004; Evenson et al. 2005; Evenson et al. 2006). Marine environmental factors have been used by investigators to explain up to 83% of the variation in recruitment and survival of coho salmon; yet in other studies about half the variation in recruitment has been attributed to freshwater factors (Coronado and Hilborn 1998; Lawson et al. 2004). Because rearing conditions at Cole Rivers Hatchery are generally similar from year to year, variation in survival of hatchery fish in the Rogue River Basin is usually attributable largely to variation in ocean survival conditions.

Table 3. Returns of wild adult coho salmon and steelhead trout to Elk Creek as compared to those that passed Gold Ray Dam, 1992-93 through 2006-07. Coho salmon less than 50 cm (jacks) and steelhead less than 41 cm (half-pounders) are included. Passage estimates at Gold Ray Dam were obtained from ODFW (Tom Satterthwaite, Grants Pass and Rene Pellissier, Central Point). ^a

Return year	Coho salmon			Steelhead		
	Elk Creek	Gold Ray Dam	% return	Elk Creek	Gold Ray Dam	% return
1992-93	40	1,770	2.3	116	8,388	1.4
1993-94	76	1,106	6.9	114	9,007	1.2
1994-95	232	3,244	7.2	204	12,857	1.6
1995-96	349	2,570	13.6	292	13,243	2.2
1996-97	319	2,572	12.4	497	15,031	3.3
1997-98	982	4,587	21.4	232	5,281	4.4
1998-99	404	1,325	30.5	362	11,196	3.2
1999-00	288	1,417	20.3	265	7,523	3.5
2000-01	698	15,460	4.5	584	9,131	6.4
2001-02	1,426	12,577	11.3	744	17,857	4.2
2002-03	1,371	11,335	12.1	1,277	27,326	4.7
2003-04	723	6,644	10.9	1,318	24,158	5.5
2004-05	2,712	11,918	22.8	694	14,504	4.8
2005-06	1,518	6,901	22.0	881	11,932	7.4
2006-07	755	4,866	15.5	1,170	15,575	7.5

^a Some of the coho salmon estimates for Gold Ray Dam were revised in spring of 2007 as a result of a thorough review of historic records. Updated estimates resulted in less than a 2% change in the 10 year averages or the averages for all years.

The number of hatchery coho salmon passing Gold Ray Dam in 2006-07 (6,502 fish) was about 57% of the average number returning in the past ten years (11,327 fish). Returns of wild adult coho salmon to Gold Ray Dam were

also well below their previous 10-year average (61.2%) suggesting that lower adult escapement levels were mainly influenced by less favorable marine environmental conditions.

No evidence was found to indicate that freshwater factors had an unusually favorable or unfavorable impact on adult escapement of coho salmon or steelhead. For coho salmon, spawning escapement into Elk Creek (723 fish) of the parent run (2003-04) run was similar in magnitude to the 2006-07 adult escapement (755 fish). While no sampling was conducted in 2004 to determine the upstream rearing distribution limits of juvenile coho salmon, USGS streamflow records (Elk Creek at Trail) indicate that streamflows during the upstream migration and spawning period (November 2003-January 2004) were within the seasonally normal range and likely provided suitable conditions for adults to access much if not most of the available spawning habitat.

While the proportion of natural steelhead production in the upper Rogue River basin that is accounted for from Elk Creek has remained lower than expected, averaging 6.0% of the Gold Ray Dam estimates for the past five years, this proportion and the number of adult steelhead returning to Elk Creek has tended to increase over time. Adult steelhead returns for 2006-07 were the third highest totals recorded in the 15-year history of the trap and haul project. Gold Ray Dam fish count data show that 2006-07 combined returns of summer and winter steelhead were near the previous 10-year averages for both hatchery and wild fish suggesting that steelhead were not as adversely impacted by ocean environmental conditions as coho salmon returning in 2006-07.

RECOMMENDATIONS

1. The procedures and methods presently used to operate the Elk Creek trap facility should continue to be employed in the 2007-08 operating season.
2. USACE should continue present efforts to plan and pursue construction of a new fish trapping facility located at the base of Elk Creek Dam. A new state-of-the-art facility would greatly reduce operation and maintenance problems and most risks associated with debris and high water events. In addition, the new facility would (1) improve fish handling methods, (2) greatly reduce migration delays, and (3) eliminate many risk factors for killing or injuring fish.
3. USACE should expedite planning and implementation of improvements to the release site upstream of Elk Creek Dam including potential construction and evaluation of a recovery channel or pool to mitigate fish handling and transportation stress.

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APPENDIX A

SUMMARY OF ELK CREEK FISH TRAPPING DATA

Table A-1. Number of adult salmonids trapped and number of salmonid mortalities at the Elk Creek Trap Facility for each season of operations.^{ab}

Return Year	Chinook salmon	Coho salmon	Steelhead trout	Cutthroat trout	Total trapped	Salmonid mortalities
1992-93	40	38	118	10	206	0
1993-94	13	77	116	63	269	0
1994-95	35	284	207	39	565	0
1995-96	82	416	309	68	875	4 adults
1996-97	39	442	541	56	1,078	2 adults
1997-98	33	1,053	239	60	1,385	2 adults
1998-99	20	429	361	81	891	1 adult
1999-00	20	362	269	51	702	2 adults
2000-01	33	775	610	49	1,467	4 adults
2001-02	11	1,552	756	139	2,458	2 adults 35 juveniles
2002-03	31	1,447	735	164	2,377	3 adults
2003-04	39	944	1,337	299	2,619	9 adults (1 ESA coho) 2 juveniles
2004-05	23	2,805	710	327	3,865	1 adult 4 juveniles
2005-06	15	1,785	900	273	2,973	10 adults (7 ESA coho) 3 juveniles
2006-07	10	1,039	1,182	149	2,380	0 adults 0 juveniles

^a Numbers include hatchery fish (strays) captured at the facility and removed (new in 2004, all hatchery coho salmon were transported alive to Cole Rivers Hatchery for ODFW disposal).

^b Mortalities do not include indirect mortality (delayed handling, trap rejection, handling or reduced distribution).

APPENDIX B

COUNTS OF FISH ATTEMPTING TO JUMP OVER THE ELK CREEK WEIR

Table B-1. Sampling data collected during the 2006-07 operating season on adult salmonids attempting to jump over the weir at the Elk Creek Trap Facility.

Date (mm/dd/yy)	Start time	Duration (min.)	Number of attempts	Successful attempts	Streamflow (CFS) ^a
12-15-06	13:20	10	7	0	1100
12-26-06	11:40	10	0	0	2140
12-26-06	14:50	15	0	0	2450
12-27-06	11:30	10	0	0	1780
12-27-06	15:30	10	1	0	1550
12-28-06	12:00	15	0	0	892
12-28-06	15:40	10	0	0	842
12-29-06	13:05	10	0	0	580
01-03-07	14:10	10	12	0	650
01-03-07	15:25	15	10	0	771
02-16-07	15:10	10	41	4	954
03-04-07	11:00	15	0	0	1180
03-04-07	14:00	10	0	0	1090
03-08-07	15:15	15	32	3	1030
03-13-07	15:30	10	27	1	815

^a Provisionary mean daily streamflow measured at USGS gage (Elk Creek at Trail).

APPENDIX C

FACILITY OPERATION AND MAINTENANCE

Overview

Rogue FishBio Services, Inc. (RFBS) assumed responsibility, under contract with the U.S. Army Corps of Engineers (USACE), for operation and maintenance of the Elk Creek fish collection facility, effective 1 December 2003. Contract activities and issues related to operating and maintaining facility components and equipment, and debris maintenance of three culverts on the Elk Creek Project property are described in this report for the fourth operating season under the contract with RFBS, 1 October 2006 to 12 May 2007.

A relatively dry October was followed by a minor storm event in early November, with adequate precipitation to permit a 3 November main pump start-up. Additional storm events of varying intensity occurred approximately every 10 to 14 days through early January. A period of dry weather persisted from early January through early February followed by a relatively wet February and early March with four moderate storm rain events during the period. Dry weather and dropping streamflows, interrupted by a single low intensity storm event, continued through the end of the operating season allowing unimpeded performance of most weir-related activities.

Peak flow during the season occurred on 26 December at 2,990 cfs (USGS gaging station, Elk Creek at Trail). Stream flows exceeded the 250 cfs safety guideline for working on the weir during approximately half of the days from December through March.

Pump Operation and Alarms

USACE personnel completed installation of automatic restart electrical components for the main pump on 8 January. The restart components were set to delay restart of the pump for 20 minutes after a shutdown caused by low water in the main sump. Clogging of the main screen by leaves and/or suspended organic material in the creek is the primary cause of low water in the main sump. The system was tested several times in January and found to work properly each test. While the system restarts the pump after shutdowns triggered by low water conditions in the sump, it does not restart the pump after brief power interruptions.

RFBS responded to ten intake pump alarms during the season (three in November, one in December, five in February, and one in March), outside of the normal on-site work schedule (0700-1600 daily). Excessive debris (leaves and/or fine suspended organic material) on the intake screens accounted for

eight of the ten pump shutdowns and alarms. Power spikes or outages likely caused the remaining two pump shutdowns and alarms. During all alarm conditions the auto-voice dialer notified RFBS personnel without error. The pump was allowed to restart automatically following the latter three alarms in February and monitored off-station using the Observer video monitoring system. On all three nights, after restarting, the pump ran continuously without problem until RFBS personnel arrived at the site for to start their regular workday schedule.

The main intake screens become clogged primarily during high runoff periods when turbidity and suspended debris loads are high. We also experienced some screen clogging problems when the weir was cleaned following high flow periods. Removal of debris from the weir results in reducing the water elevation immediately upstream of the weir and increasing current velocity, thus, mobilizing debris deposited in the stilling area downstream of Elk Creek Dam. We were able to avoid pump shutdowns by cleaning the weir over 2-3 days, reducing rapid decreases in the pool elevation upstream of the weir and extending the period that additional debris became mobilized.

The intake pump was turned off for a total of fourteen nights during the 2006-07 season due to high suspended debris loads (ten nights in December and four nights in January). On all nights that the pumps was left off, due to high water elevations in the stream, some water continued to gravity feed through the pump and into the trap. A ½ HP submersible pump was used throughout the season as a backup water supply delivering an added 50-55 gpm of water to the head of the trap pond through a 2-inch water line (originally installed during the 2004-05 season). The back-up system was left on continuously at night and was operated on all but four nights during the 2006-07 season. On these four nights, the pump shut down unexpectedly due to a suspected clogged pump impeller.

The previous 4-call capacity auto-dialer for the intake pump alarm notification system was replaced on 4 October with an 8-call capacity auto-dialer allowing additional phone numbers to be programmed into the emergency contact list. In addition, DSL internet service became available during the summer of 2006, with services activated prior to the start of the operating season, at both the RFBS home office and at the trap site. The DSL internet phone service technology allows on-line use and regular phone service use simultaneously on a single phone line. These changes greatly reduce the possibility that alarm notification calls from the auto-dialer will fail to connect with a RFBS employee during an alarm condition.

Intake Screens

The intake for the trap water supply pump is fitted with two stationary flat panel screens that are set parallel to the streamflow. The screens are not fitted with self-cleaning devices and therefore require manual cleaning. The screens are positioned parallel to the streamflow, which ensures that virtually all larger debris and much of the smaller debris sweeps past the screen surfaces without becoming impinged. Most material that impinges on the screens is comprised of leaves and finer suspended debris.

Intake screens were normally cleaned a minimum of twice daily. The screens required more frequent cleaning during high water periods when greater amounts of suspended debris were present. During some storm events, the screens required cleaning one or more times during the night hours to avoid excessive plugging and automatic shutdown of the intake pump. Installation of a self-cleaning system for the screens would improve the operation of this component of the facility.

Weir Cleaning and Maintenance

Safety concerns, due to high streamflows, prevented weir cleaning activities and inspection of the weir for fish carcasses on 68 days during the season. All of these days occurred in the December through March time period. Weir-related activities were conducted all other days from October to the end of the season. To maintain greater wetted surface area on the intake screens during lower flow conditions, some debris was allowed to accumulate on the bottom 1/3 of the weir. Several small areas, spaced evenly across the length of the weir, were cleaned of all debris to provide pathways for downstream migrating juvenile salmonids. Other maintenance performed on the weir included the replacement of several broken or badly bent pickets which were damaged by large floating debris or were severely rusted.

Culverts

The culverts on West Branch, Alco and Middle creeks were inspected six times during the 2006-07 operating season (27 October, 8 December, 28 January and 1 February, 29 March, 18 April and 9 May). Only small amounts of debris were ever removed from any one culvert.

Equipment Repair, Maintenance and Improvements

RFBS and the USACE performed several equipment repair/replacement, maintenance and improvement tasks during the season including:

- installation of electrical components to automatically restart the main intake pump 20 minutes after shutdowns caused by low water in the intake sump (USACE);
- emergency repair of a ruptured air supply hose for the 14-inch knife valve, the second rupture to occur in the same location in 3 years (RFBS);
- replacement of the 4-call auto-dialer with an 8-call auto-dialer, and programming of additional contact numbers in the dialer sequence (RFBS);
- upgrades to DSL internet service at the RFBS home office and the Elk Creek Trap office providing greater assurance of the auto-dialer connecting with RFBS personnel during alarm conditions (RFBS and USACE);
- weekly lubrication of the pump shaft bearings and additional periodic lubrication of chain sprockets, pulleys and the cable drum for the hydraulic pump and chain hoist system (RFBS);
- daily purging of moisture from the compressed air tank and monthly inspection of air system filters and water separators (RFBS).
- re-painting of the brail hoist cable at stop points (RFBS);
- repair/replacement of dipnet bags (RFBS);
- installation of a new kitchen sink faucet at the worksite office (RFBS); and
- replacement of a broken office stair tread (RFBS).

Grounds Maintenance

RFBS performed routine grounds maintenance and clean-up tasks during the season including leaf raking, grass and brush cutting, burning of leaf and brush piles, and trimming brush around the driveway at the main entry gate.

Fish Transport and Holding Equipment

As in our three previous seasons, RFBS transported fish to the release site upstream of the dam in a 350 gallon capacity portable tank mounted on a one-ton truck. We experienced no significant operational problems with the fish transportation equipment. A total of 181 trips were made from the fish trap to the primary release site. No trips to the secondary release site on West Branch Elk Creek were required this season.

We used a 150 gallon stock watering trough fitted with an aluminum screen cover to temporarily hold small numbers of hatchery marked coho salmon that were transported to Cole M. Rivers Hatchery for disposition by ODFW. We supplied water to the tank with two small electric utility pumps. We normally held small numbers of fish (up to 5 fish) in the tank for up to two days before transporting them to the hatchery to minimize the number of trips. No other significant problems were experienced with the fish transport or temporary holding equipment.

Safety

RFBS held five employee safety meetings, one each month during the November through March time period. In addition to discussions of project safety and training issues, employees also viewed safety videos obtained from SAIF Corporation on chainsaw safety, lockout/tagout procedures, fire in the workplace, electrical safety, safety on the job, and fall prevention.

A motor vehicle accident involving the fish transport truck occurred on 14 November 2006 on Elk Creek Road at the entrance to the trap facility. The accident occurred when RFBS personnel were returning to the facility after transporting a load of fish upstream. The RFBS truck was attempting to turn left into the facility entrance when another vehicle attempted to pass the RFBS truck on a corner and over a double yellow line, striking the RFBS vehicle. No injuries occurred to either of the two RFBS personnel, or the driver and only occupant of the other vehicle. Relatively minor damages were sustained to the RFBS truck, which did not disrupt fish transport operations. The other vehicle was totaled. An accident report was completed and sent to the Oregon DMV.

No other accidents and no injuries were reported during the season by project personnel at the Elk Creek Trap and Haul site. RFBS personnel reported working a total of 2,576 hours at the facility during the season.

RECOMMENDATIONS

Following the 2006-07 operating season and prior to this report, USACE Lost Creek Project personnel completed the following actions to address recommendations submitted by RFBS:

1. The main pump restart system was modified to allow automatic restart of the pump after brief power interruptions; previous modifications covered automatic restarting of the pump after the main sump low-water sensor shuts it down.

2. The air supply hose to the 14" valve for the main water supply line to the trap was replaced. The hose ruptured this season for the second time in the past three years indicating that it was deteriorating.
3. Repairs were completed to the facility access road to address the deteriorating road surface.